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that the "Sigillariæ are to be regarded as a central generalized group, from which, in regard to structure and affinities, various genera radiate towards Cycads and Conifers on the one hand and Lycopods and Equisetums on the other." D. P. P.

PETROGRAPHY.

The Classification of Igneous Rocks. — Messrs. Iddings[1] and Cross[2] have contributed two interesting articles on that most attractive of all petrographical problems, the classification and naming of igneous rocks. Although attacking the subject from entirely different standpoints, both authors nevertheless reach approximately the same conclusions. Cross declares that "the impossibility of setting up an all-embracing natural classification of igneous rocks is not due to ignorance. It comes from the nature of the rock. The more we know the less shall we be able to include all relations in one classification." Iddings states "that a systematic classification of all kinds of igneous rocks cannot be put on the same basis as a philosophical treatise of the subject-matter of petrology, which takes cognizance not only of the material character of rocks, but also of the laws governing their production, eruption, mode of occurrence, and solidification, as well as their subsequent alteration."

Iddings discusses critically, with the aid of diagrams, the composition of igneous rocks, as indicated by nine hundred and fifty-eight analyses, and shows that no chemical classification will exhibit the true genetic relationships existing between different rock types, and that a mineralogical classification is likewise useless for this purpose. It is, therefore, of no avail to attempt a genetic classification of rocks if it is desired by the classification to group together those rocks that have like characters, in order that they may receive a common name. The present classification, and the nomenclature to which it has given rise, are both unsatisfactory. The need for a new nomenclature is especially pressing, and yet "the condition of our knowledge at present is scarcely such as to warrant the immediate attempt to create a systematic nomenclature."

The point of Cross's paper is to the effect that the present unsatisfactory condition of rock classification is due to the fact that too many relationships are expected to be shown in it. He believes "that no great progress in systematic petrography is possible until a more rational view of the relationship of that science to geology prevails among its devotees." The rock, in petrography, is a unit of material; while in geology it is a unit of form or mass. The geological rock is the subject of study in *petrology*. The classification of rocks in *petrography* should be a classification based on facts and not on theories; it should be based on the properties of the rocks themselves, and upon their relationships to one another and to the earth. No natural classification of rocks is possible, because of the nature of these bodies. "The systematic classification of rocks, according to which their specific names are applied, must be based on their properties as objects, together with only such geological criteria as may be found adaptable, to the end that the system may be uniform, stable, and as natural as possible." The author examines critically the accepted scheme of classification as now used, and shows that it is illogical, being based primarily on geological criteria that are largely theoretical. He objects also to the founding of the classification upon such hypothetical factors as those embraced in the theory of magmatic differentiation. On the other hand, "the material properties of igneous rocks afford ample criteria for establishing a systematic classification. . . . Since the geological factors of age, or of form, or place of occurrence, are not directly causes of the properties used in classification, they cannot be applied to produce coördinate groups."

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[1] Iddings, J. P. On Rock Classification, *Journ. of Geol.*, vol. vi, p. 91.

[2] Cross, W. The Geological *versus* the Petrographical Classification of Igneous Rocks, *Journ. of Geol.*, vol. vi, p. 79.

Leucite Rocks from Montana. — In another paper Cross[1] reports the existence of a most interesting series of leucite rocks at the Leucite Hills and Pilot Butte, Wyoming. Some of these rocks have already been described by Zirkel, Emmons, and Kemp, but none of these geologists had learned of the great variety of types in the region. The principal area of leucite rocks is a mesa whose top consists of a surface flow of porous and massive rock material, the latter of which corresponds to Zirkel's leucitite, while the vesicular rock is a sanidine-leucite aggregate. The massive rock is redescribed by Cross as consisting of phlogopite crystals in a groundmass made up of leucite crystals and anhedra, separated from one another by pale green or colorless microlites of diopside, imbedded in a very siliceous glass. This rock the author calls *wyomingite*.

The principal rock of the Leucite Hills is the sanidine-leucite

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[1] *Amer. Journ. Sci.*, vol. iv, p. 115, 1897.